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DEDICATION CEREMONIES

SELECTIVE SEQUENCE ELECTRONIC CALCULATOR

INTERNATIONAL BUSINESS MACHINES CORPORATION

January 27, 1948
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The Dedication Ceremonies of the IBM Selective Sequence Electronic Calculator were held on January 27, 1948, at two-twenty o'clock, in the 57th Street building of World Headquarters, Mr. Thomas J. Watson, President, presiding.

PRESIDENT WATSON: Now if we can have your attention please: As we stand within the structure of the new Electronic Calculator, I am moved by three related things--all three concern the sciences of our nation and of our world.

First, I am deeply impressed with the scientific progress that has made necessary the construction of such a machine. Second, I have profound admiration for the scientific progress that has made possible its construction. And third, I am fully aware of the fact that this calculator is simply a small tool to assist in the work that our great scientists are carrying on for the benefit of mankind.

It is with a mixed feeling of humility and of confidence in the future, therefore, that I dedicate the Selective Sequence Electronic Calculator for the use of science throughout the world.

Mr. Hamilton! [Applause]

MR. F. E. HAMILTON: The problem on which the calculator is engaged is computing with the greatest possible accuracy the position of the moon for any given time. The necessary equations for this computation are shown on the easel in front of me, and you can see them a little later when it's

more convenient. These equations have been transcribed into standard IBM punched cards, which have been processed to put them into proper form for the calculator. The final data for the problem is summarized at the bottom of this chart that I have previously referred to.

As all of you are not in a position to see it, I will approximate the figures that are given on it.

The basic input and instructions consist of 165,000 digits. Eleven hundred lines of instructions are coded to make this computation. These are expanded to 10,350 lines by reference to subsequence coding for repetitive operations that occur during the computation. There are 11,000 additions, 9000 multiplications, 2000 references to a hundred value sine table used in the computation.

Seven minutes are required to perform all these operations that I have outlined. The product of a manual multiplication of two 14-digit numbers involves the actual writing of 252 digits, disregarding all the time that is required for the mental work associated with the multiplication. This 14-digit multiplication is typical of the 9000 that we are doing in this computation at the rate of 50 per second.

Division of two 14-digit numbers producing a 14-digit quotient is performed at the rate of 33 per second. Additions or subtractions producing 28-digit sums or differences are performed at the rate of 3500 per second.

Data may be fed into a calculation from punched paper

tapes at the rate of 140,000 digits per minute. The selection of any one of a hundred sines used in the calculation requires but a quarter of a second.

The productivity of this calculator is at least 250 times as great as that of the IBM Automatic Sequence Controlled Calculator which we completed in 1944.

A description of the operation of the calculator will now be made by Mr. Seeber, whose mathematical background and wide experience in large-scale computing has been invaluable on this project. Mr. Seeber! [Applause]

MR. R. R. SEEBER, JR.: Thank you, Mr. Hamilton.

Mr. Watson, Ladies and Gentlemen: Mr. Hamilton has indicated that the basic data for the problem, as well as the instructions that are used in controlling the operation of the machines, are prepared on standard IBM punched cards with the use of standard equipment. A card such as I have here represents data that is coded for controlling the operation of the machine, and it would be punched up on a punch similar to the first machine that is below the steps. This machine is not connected with the calculator itself, but is typical of machines that are auxiliary to it and used in the preparation of data.

When the cards are prepared in this fashion they may be read into the machine through the first unit that you see below me. This is a card-reading unit, and standard IBM punched cards may be read in there, either to represent numerical data or to represent instructions for the operation of the

machine.

Numbers coming in from this sources are stored in a memory unit, which is made up of electromagnetic relays, such as the one I have here. This relay memory unit is one of the largest and fastest memory units and has about 3000 digits of storage in it--and it is beyond the south wall: relay racks beyond the glass encasement.

The first tube frame that is on the east side of the room represents tubes that are used for converting the numbers from the card-feeding units into the relay memory section. Proceeding along the east wall, the next sections represent the sequence or overall master controls of the machine, that control its operation. That includes a section of tubes and four relay frames. These relays are of the same general type as the one I exhibited and represent the numerous circuits that can be set up in the machine. There are many individual circuits, and the total number of combinations literally runs into the billions.

The lights that are flashing in this same section represent numbers that are in the process of being transmitted throughout the machine from one unit to another. They are represented by a group of 80 lights with a representation of 20 digits of numerical information.

In the next section there is another group of lights which represents the coding or instructional data that is in

the machine at a particular time, telling the machine what operations it must perform.

As Dr. Eckert pointed out in his speech, if a difficult operation would indicate to the machine that a multiplication was to be performed, it would show where the multiplier was to be found, where the multiplicand was to be found, and finally where to deliver the product after the multiplication was complete, and the numbers would be shifted to eliminate unnecessary figures.

At the south end of the room are tape-reading units. These can also be used for the input of the data, either of numerical data for the basic data of computation or for instructional data.

In case tapes are used, the punched cards, as I illustrated, are made into tapes. Here is a sample of a tape that would be used in one of these reading units. This is prepared automatically by the first machine in the north end of the west side of the room. When these tapes are mounted in the machine, they may be read at the rate of 140,000 digits, and they supply the data necessary not only for numerical information but also for the operation of the sequencing.

The tape units have two additional functions. The ones that are located on the east wall are used as the table look-up or directory units that Dr. Eckert referred to, where

a search may be made for a particular value and functions associated with that value read out into the computing system.

The tapes at the end of the room, as well as having their reading ability, have associated with them three tape punches. These tape punches allow information as computed in the machine to be recorded in the tapes for subsequent read-out at a later stage. These units provide our large-scale storage, and the tape units combined provide a storage total of 400,000 digits.

On the west wall of the room are our principal electronic units. Starting from the north end, the first four panels represent electronic memory units. These are high-speed memory units where numbers may be recalled in very small portions of a second and numbers made generally available from transmissions that occur from units throughout the machine. This is a sort of central switching station which allows the high speed of the electronic unit to be used most effectively.

The next two frames represent interlocks and basic control circuits which supply the pulses that control the circuit and also interlock the various transmissions to make sure that there shall be no cross-up between transmissions on one unit and transmissions on another.

There is a small scope on the second of these two frames that shows one of the basic pulses that is in use in the machine.

The last five frames on this side of the room represent the arithmetical units The first three of them represent the cumulator where numbers may be added, subtracted, and the column shift control which allows the rearrangement of numbers to cutt of unnecessary figures and properly position the decimal point. The last two panels have the multiplying and dividing unit, and as such perform the high-speed multiplications.

For output of results we have two card punches in this section of the room, which allow us to return our data to punched card form so that we may enjoy the flexibility of standard IBM punch card equipment for the rearrangement of data, collating the results and printing of tables in final form by a card-operated typewriter that you will see in the north end of the room.

We also have two high-speed printers which are located near the south end of the room where intermedial results are printed as they arise in the machine. Across from these printers is a central console which is the control desk and indicating panel. The lights on that panel indicate the progress of the computation throughout the machine, showing the various circuits that are activiated at any particular time. Manual switches permit operation for testing purposes.

One thing that I have not mentioned, but which is most important is the fact that you might say that the principal part of the machine is right under the floor where you are standing. The floor is full of the cables that interconnect these

various units and make the operation of the machine so complete.

Those of you who are above the steps will now realize that you are really within the machine, with the basic units around you in a U, the important cables below you, air ducts for the air conditioning in the ceiling overhead.

It has been mentioned that there will be a technical session tomorrow morning at ten o'clock, and that all of you are cordially invited to attend, at which time there will be a more detailed description of the machine. If you have brief questions that you may want to ask, there are many of our engineers around, wearing tags on their lapels, and they may be questioned as to brief points, such as speeds of operation and questions of that character.

Thank you. [Applause]

PRESIDENT WATSON: I want to thank Mr. Hamilton, and Mr. Seeber for giving us this brief description of the machine.

I also wish to recognize all of my scientific friends everywhere, who during the past third of a centry, my operation in this line--I have received advice and counsel from. I want everyone who has participated with me in any way to know that I do appreciate their worth as advisors during the third of a century in which we have been working up to what we have explained to you today.

Thank you very much, and we hope that the scientists

will be with us tomorrow to dig into the machine and know intimately all about it.

And to all of our other friends assembled here from the business world, this room is a permanent exhibition and is open to you at any time, any day in the week.

One other word, please: If there are any present who would like to remain after this meeting to gain more intimate knowledge, we'd be very happy to have you do so.

Thank you. [Applause]

[The meeting adjourned at two twenty-five o'clock.]